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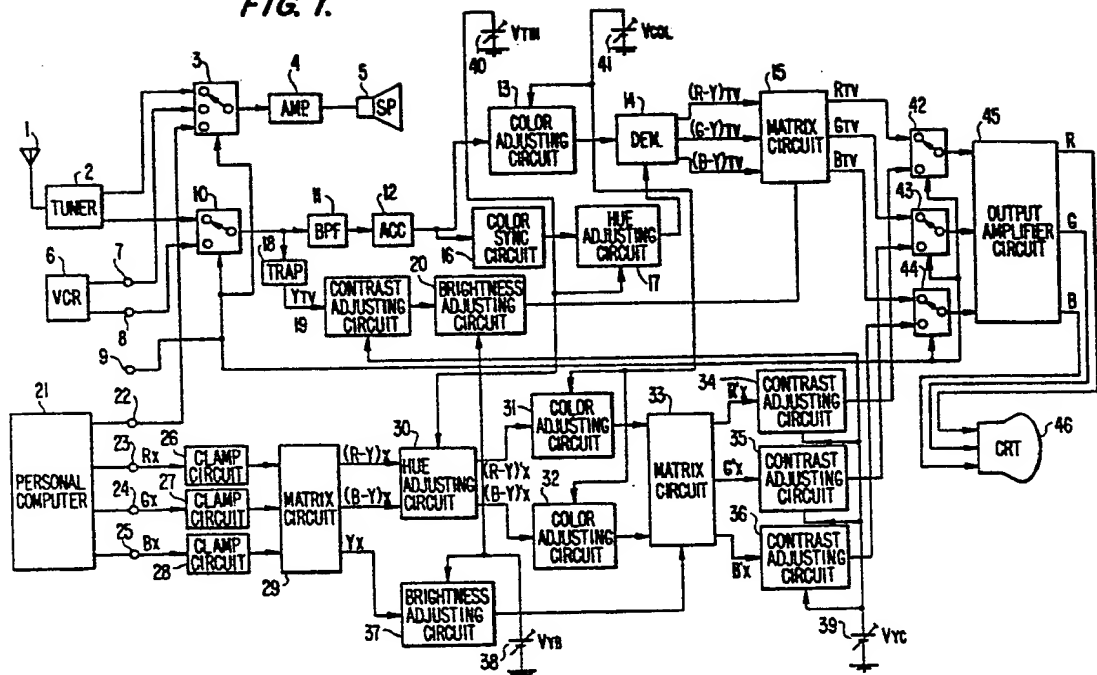
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(54) Color tone adjusting device.

(57) In order to adjust the hue in a color picture reproduced in response to color difference signals, there is provided a converter for converting a pair of color difference signals to another pair of color difference signals, each pair of color difference signals defining the same color vector in different color vector planes having a common origin. The converter includes first amplifiers which amplify the color difference signals with a gain which varies according to a sine function in response to a common control signal second amplifiers which amplify the color difference signals with a gain which varies according to a cosine function in response to the common control signal, and an adder circuit which adds the outputs of one set of first and second amplifiers and a subtracter circuit which subtracts the outputs of another set of first and second amplifiers.

EP 0 221 254 A2

FIG. 1.



Background of the Invention:

1 The present invention relates to a color tone adjusting apparatus for a color display device equipped with red (R), green (G), and blue (B) signal input terminals.

5 Accompanying the recent widespread use of VCRs and personal computers, color television receivers are now changing from those of a single function type which simply receive and produce broadcasted signals into those of a multi-function type equipped with composite color video signal input terminals for VCRs and RGB input terminals for
10 computers, i.e., for receiving R, G, and B signals.

 A color television receiver has heretofore been equipped with such functions as hue adjusting (to change the tint) and contrast adjusting (to change the degree of brightness) to adjust the picture quality to adapt to a viewer's liking.

15 In the case of color television receivers of the conventional NTSC system, the phase of the carrier signal is deviated in order to adjust the hue in the reproduced picture for demodulation, which is in synchronism with the color burst signal of the chrominance subcarrier, that is, the
20 demodulating axis for the chrominance signal in the demodulating circuit is deviated, as described in IEEE Transactions on Consumer Electronics, Vol. CE-21, No. 2, May, 1975, pp. 164-169. However, attention has not been given to
25 adjusting the hue when the signals to be reproduced by the color television receiver are input through the RGB input terminals.

SUMMARY OF THE INVENTION:

1 The object of the present invention is to provide a color tone adjusting apparatus which is capable of adjusting the hue even if primary color signals are applied thereto.

5 To achieve the above-mentioned object according to the present invention, attention is given to the fact that the adjustment of hue is accomplished by turning the vector plane for the color signal around the origin, which vector plane represents colors with the ordinate as (R-Y) and the abscissa as (B-Y), for instance. Namely, the present invention
10 comprises a matrix circuit which converts primary color signals, such as R, G, and B signals, into a pair of two color difference signals, such as (R-Y) and (B-Y) signals, on one color vector plane, a hue adjusting circuit connected to receive the above two color difference signals and a control
15 voltage for producing another pair of two color difference signals on another color vector plane which is equal to said one color vector plane rotated through a rotation angle responsive to said control voltage.

BRIEF DESCRIPTION OF THE DRAWINGS:

20 Fig. 1 is a block diagram showing one embodiment of the present invention;

 Fig. 2 is a block diagram showing one example of the hue adjusting circuit shown in Fig. 1;

25 Fig. 3 is a vector diagram showing color difference signals;

1 Fig. 4 shows characteristics of the control voltage generator shown in Fig. 2;

 Fig. 5 is a block diagram showing one example of the internal structure of a control voltage generator;

5 Figs. 6 and 7 are vector diagrams for explaining the operation of the control voltage generator circuit;

 Fig. 8 is a block diagram showing another embodiment of the present invention;

10 Fig. 9 is a diagram which shows in detail the control voltage generator;

 Fig. 10 is a diagram which shows in detail the gain control circuits;

 Fig. 11 shows characteristics of the circuit shown in Fig. 9;

15 Fig. 12 shows the characteristic of the circuit shown in Fig. 10;

 Fig. 13 is a block diagram showing another example of control voltage generator;

20 Fig. 14 shows the characteristic of the circuit shown in Fig. 13;

DESCRIPTION OF THE PREFERRED EMBODIMENTS

 The invention will be explained below in conjunction with the drawings.

25 Fig. 1 is a block diagram illustrating an embodiment according to the present invention wherein reference numeral 1 denotes an antenna, 2 denotes a tuner including a video

detector and a sound detector which selects any station among the broadcasted signals received by the antenna 1 and which produces a sound signal and a composite color video signal (hereinafter referred to simply as a video signal). A switching circuit 3 switches the sound signal to be produced, an amplifier 4 amplifies the sound signal, and a speaker 4 reproduces the sound.

Reference numeral 6 denotes a VCR having terminals 7 and 8 which receive a sound signal and a video signal produced from the tuner 2 and the VCR 6. Reference numeral 11 denotes a band-pass filter (hereinafter referred to as a BPF) for extracting the chrominance signal from the video signal, 12 denotes a ACC circuit (for automatically adjusting the level of the chrominance signal to a given value), 14 denotes a demodulator which demodulates the chrominance signal to produce three color difference signals $(R-V)_{TV}$, $(G-Y)_{TV}$ and $(B-Y)_{TV}$, 16 denotes a color synchronizing circuit for generating a carrier signal that is used for demodulating the chrominance signal in the demodulator 14, and 17 denotes hue adjusting circuit which changes the demodulating axis for the chrominance signal in the demodulating circuit 14 by changing the phase of the carrier signal generated by the synchronizing circuit 16.

Reference numeral 18 denotes a trap filter which attenuates only the chrominance signal in the video signal to extract a brightness signal Y_{TV} , 19 denotes a contrast adjusting circuit, 20 denotes a brightness adjusting circuit

1 (to adjust the brightness), and 15 denotes a matrix circuit
which receives the three color difference signals $(R-Y)_{TV}$,
 $(G-Y)_{TV}$, $(B-Y)_{TV}$, and the brightness signal Y_{TV} to produce
three primary color signals R_{TV} , G_{TV} and B_{TV} .

5 Reference numeral 21 denotes a personal computer, 22
denotes a terminal which receives the sound signal produced
from personal computer 21, reference numerals 23, 24 and 25
denote input terminals which receive three primary color
signals R_X , G_X , B_X produced from the personal computer,
10 reference numerals 26, 27 and 28 denote clamp circuits (for
clamping the input signals to desired DC potentials), 29
denotes a matrix circuit which receives three primary color
signals R_X , G_X , B_X from the clamp circuits 26, 27, 28 to
produce two color difference signals $(R-Y)_X$ and $(B-Y)_X$ and a
15 brightness signal Y_X , 30 denotes a hue adjusting circuit
which receives the two color difference signals $(R-Y)_X'$ and
 $(B-Y)_X'$, which are obtained as a result of hue adjusting
operation, reference numerals 31 and 32 denote color adjust-
ing circuits, 37 denotes a brightness adjusting circuit, 33
20 denotes a matrix circuit which receives color difference
signals $(R-Y)_X'$ from color adjusting circuits 31, 32 and
receives brightness signal Y_X from brightness adjusting
circuit 37, and which produces three primary color signals
 R_X' , G_X' , B_X' , and reference numerals 34, 35, 36 denote
25 contrast adjusting circuits.

Reference numerals 42, 43, 44 denote switching circuits
for switching the three primary color signals R_{TV} , G_{TV} , B_{TV}

1 produced from the matrix circuit 15 and the three primary
color signals R_X' , G_X' , B_X' produced from the matrix circuit
33 via contrast adjusting circuits 34, 35, 36, reference
numeral 45 denotes an output amplifier circuit which drives
5 the color cathode-ray tube 46.

Reference numeral 38 denotes a variable voltage source
which generates a DC voltage V_{YB} to control brightness
adjusting circuits 20 and 37, reference numeral 39 denotes a
variable voltage source which generates a DC voltage V_{YC} to
10 control contrast adjusting circuits 19, 34, 35 and 36,
reference numeral 40 denotes a variable voltage source which
generates a DC voltage V_{TIN} to control the hue adjusting
circuits 17 and 30, reference numeral 41 denotes a variable
voltage source which generates a DC voltage V_{COL} to control
15 the color adjusting circuits 13, 31 and 32, and reference
numeral 9 denotes an input terminal which receives a switch-
ing signal to control the switching circuits 3, 10, 42, 43
and 44.

Fig. 2 is a block diagram showing the internal structure
20 of hue adjusting circuit 30 of Fig. 1, and wherein reference
numeral 101 denotes an input terminal which receives voltage
 V_{TIN} as the hue adjusting voltage, reference numerals 103 and
105 denote input terminals which receive color difference
signals $(R-Y)_X$, $(B-Y)_X$, reference numerals 107, 109, 111 and
25 113 denote variable gain circuits, 115 denotes a control
voltage generator which generates a gain control voltage V_{cos}
to control the variable gain circuits 107, 111 and a gain

control voltage V_{sin} to control the variable gain circuits 109 and 113, reference numeral 117 denotes a subtracter circuit, 119 denotes an adder circuit, and 121 and 123 denote output terminals. The operation of the hue adjusting circuit 30 shown in Fig. 2 will be described below in conjunction with Fig. 3.

The intensity of the color difference signal $(R-Y)_x$ input from the terminal 103 is now denoted by V_a , and the intensity of the color difference signal $(B-Y)_x$ input from the terminal 105 is denoted by V_b . On a vector plane in which the ordinate is represented by $(R-Y)_x$ and the abscissa is represented by $(B-Y)_x$, the colors are then represented as vectors having an intensity $|F|$ and an angle θ relative to the axis $(B-Y)_x$ as shown in Fig. 3, i.e.,

$$V_a = |F| \cdot \sin \theta \quad \dots (1)$$

$$V_b = |F| \cdot \cos \theta \quad \dots (2)$$

Hue adjusting involves rotation of the vector plane, that is, vector 100 whose absolute value is $|F|$ and whose angle is θ shown in Fig. 3 is reproduced as a color wherein blue and red difference signal components are V_b and V_a respectively, in a vector plane determined by $(B-Y)_x$ and $(R-Y)_x$, and is also reproduced as a color wherein blue and red difference signal components are V_h and V_g , respectively, in a vector plane determined by $(B-Y)'_x$ and $(R-Y)'_x$, the latter plane being rotated from the former plane with a rotation angle α . That is, the intensities of signals V_g and V_h on the axes that are turned on an angle α , are given by

$$\begin{aligned} V_g &= |F| \cdot \sin (\theta - \alpha) \\ &= |F| \cdot (\sin \theta \cdot \cos \alpha - \cos \theta \cdot \sin \alpha) \quad \dots (3) \end{aligned}$$

$$\begin{aligned} V_h &= |F| \cdot \cos (\theta - \alpha) \\ &= |F| \cdot (\cos \theta \cdot \cos \alpha + \sin \theta \cdot \sin \alpha) \quad \dots (4) \end{aligned}$$

If the equations (1) and (2) are substituted for the equations (3) and (4), there are obtained the following equations:

$$V_g = V_a \cdot \cos \alpha - V_b \cdot \sin \alpha \quad \dots (5)$$

$$V_h = V_b \cdot \cos \alpha + V_a \cdot \sin \alpha \quad \dots (6)$$

As will be obvious from the above equations (5) and (6), the color difference signals $(R-Y)_x$ and $(B-Y)_x$ are respectively obtained by subtracting and adding the input color difference signals $(R-Y)_x$ and $(B-Y)_x$ which have been multiplied by $\cos \theta$ and $\sin \theta$ times at an angle α .

The hue adjusting circuit 30 shown in Fig. 2 adjusts the hue according to the above-mentioned method. Namely, the variable gain circuit 107 which receives the color difference signal $(R-Y)_x$ produces an output V_c of which the intensity is controlled by the control voltage V_{cos} .

Further, the variable gain circuit 109 which receives the color difference signal $(R-Y)_x$ produces an output signal V_d the intensity of which is controlled by the control voltage V_{sin} generated by the control voltage generator 115, and the variable gain circuit 113 which receives the color difference signal $(B-Y)_x$ produces an output signal V_f the intensity of which is controlled by the control voltage V_{sin} .

1 The gains of the variable gain circuits 107, 109, 111 and 113 are linearly changed in response to control voltages applied thereto, within a range between +1 and -1.

5 Responsive to the voltage V_{TIN} , the control voltage generator 115 produces a control voltage V_{cos} that varies in compliance with a cosine function curve, and produces a control voltage V_{sin} that varies in compliance with a sine function curve, as shown in Fig. 4.

10 Therefore, the output V_c from the variable gain circuit 107 is equal to the first term on the right side of the equation (5), the output V_d from variable gain circuit 109 is equal to the second term on the right side of equation (6), the output V_e from variable gain circuit 111 is equal to the first term on the right side of equation (6), and the output
15 V_f from variable gain circuit 113 is equal to the second term on the right side of equation (5). Accordingly, the output V_g from subtracter circuit 117 is given by the equation (5) and output V_h from adder circuit 119 is given by equation (6).

20 As described above, the hue adjusting circuit 30 produces two color difference signals $(R-Y)'_x$ and $(B-Y)'_x$ that are adjusted in hue from color difference signals $(R-Y)_x$ and $(B-Y)_x$ input thereto. Namely, the color television receiver described in this embodiment is capable of adjusting
25 the hues even when the three primary color signals R_x , G_x , B_x are input.

0221254

Fig. 5 is a block diagram which illustrates the structure of control voltage generator 115 shown in Fig. 2, and wherein reference numeral 160 denotes an oscillator, 161 denotes a phase shifting circuit which shifts the output V_n from oscillator 160 by +90 degrees, 168 denotes an input terminal which receives voltage V_{TIN} , 162 denotes an adder circuit for adding the output V_m from phase shifting circuit 161 and the output V_n from oscillator 160 with the ratio for addition in responsive to voltage V_{TIN} , reference numeral 163 denotes a phase shifting circuit which shifts the phase of the output V_Q from adder circuit 162 by -45 degrees, 164 denotes a multiplier circuit which multiplies output V_M by output V'_Q to produce control voltage V_{sin} at output terminal 166, 165 denotes a multiplier circuit which multiplies output V_n by output V'_Q to produce the control voltage V_{cos} at output terminal 167.

The operation of the control voltage generator circuit 115 shown in Fig. 5 will be described below in conjunction with Figs. 6 and 7.

The signal V_n produced from oscillator 160 and the signal V_m produced from phase shifting circuit 161 have a phase difference of 90 degrees relative to each other, and have the same intensity which is set to be 1. The signals V_n and V_m are added together by the adder circuit 162. In this case, the ratio of addition is controlled by voltage V_{TIN} as given by

$$K \cdot |V_n| + (1 - K) \cdot |V_m| = 1$$

1 where K denotes a parameter responsive to voltage V_{TIN}
($0 \leq K \leq 1$).

As shown in Fig. 6, therefore, the output V_Q from adder
circuit 162 moves along a straight line that connects V_m and
5 V_n , depending upon the voltage V_{TIN} . Here, it is presume
that the output V_Q has a phase that is deviated by β from the
phase of the output V_n are detected in multiplier circuits
164 and 165 are given, from Fig. 7, by

$$V_{sin} = |V_m| \cdot \sin(\beta - 45^\circ) \quad \dots\dots (7)$$

10 $V_{cos} = |V_n| \cdot \cos(\beta - 45^\circ) \quad \dots\dots (8)$

Thus, responsive to a change in the voltage V_{TIN} , angle
 β is changed so that the output V_{sin} changes in compliance
with a sine function curve and the output V_{cos} changes in
compliance with a cosine function curve. Since β changes
15 within a range between 0° and 90° ($\beta - 45^\circ$) changes within
a range -45° and $+45^\circ$ *υθισεισοσε, ιξ σειτροξε το υθι χουμυαηε*

X_{TIE} , voltages V_{sin} and V_{cos} can be changed along the solid
lines shown in Fig. 4.

Fig. 8 is a block diagram of the color tone adjusting
20 device according to another embodiment of the present
invention, wherein the same elements as those of Fig. 1 are
denoted by the same reference numerals. In Fig. 8, reference
numeral 14' denotes a demodulator which demodulates the
chrominance signal to produce two color difference signals
25 $(R-Y)_{TV}$, $(B-Y)_{TV}$ and $(R-Y)_X$, $(B-Y)_X$, respectively, and 73
denotes a switching circuit for switching the brightness
signals Y_{TV} and Y_X .

1 This embodiment is different from that shown in Fig. 1
with respect to the following point. That is, there are two
adjustment circuits, one of which is for the signal from
tuner 2 or VCR 6, and the other of which is for the signal
5 from personal computer 21 in the first embodiment.

 According to the second embodiment on the other hand,
there is provided one adjustment circuit which can process
both signals. This makes it possible to simplify the
construction of the color television receiver.

10 Furthermore, since in this embodiment the hue is
adjusted by relying upon the two color difference signals,
demodulated at demodulator 14', it is possible to adjust the
hue even in those cases in which the hue could not be
adjusted by changing the demodulation axis, such as in the
15 color television receiver for the conventional SECAM system
in which the chrominance signals had been frequency-
modulated.

 Fig. 9 is a detailed circuit diagram for the control
voltage generator 115 shown in Fig. 5. If the signal at the
20 emitter of transistor 200 is assumed to be V_m , the phase of
the collector current of transistor 284 in multiple circuit
165 is the same as that of signal V_m , because the phase
of signal V_m is inverted by transistor 248 in adder circuit
162 and inverted again by transistor 284. Since the phase V_m
25 is delayed by 90° by capacitor 224 and inverted by transistor
110 in multiplier circuit 164, the phase of the collector
current of the transistor 262 is advanced by 90° with respect

1 to that of the collector current of transistor 284. The
phase of the collector current of transistor 252 is equal to
that of the collector current of the transistor 262, which
corresponds to that of signal V_m and the amplitude of
5 collector current of transistor 252 is responsive to voltage
 V_{TIN} supplied to terminal 168. Also the phase of the
collector current of transistor 258 is equal to that of the
collector current of transistor 284, which corresponds to
that of signal V_m and the amplitude of the collector current
10 of transistor 258 is responsive to the voltage V_{TIN} , but the
changes which occur in these two collector currents are
differential. Therefore, added signal V_Q is produced at a
junction point of the collectors of transistors 252 and 258.
However, since phase shifting circuit 163 comprising resistor
15 292 and capacitor 294 operates as a common load to tran-
sistors 252 and 258 to delay the phase of the signal at the
junction point by -45° , the signal at the junction point is
signal V_Q' . The phase of signal V_Q' can be changed in the
range between -45° and $+45^\circ$, because the phase of the signal
20 V_Q can be changed in the range between 0° and 90° . The
circuit configurations for adding circuit 16 and multiplier
circuits 164 and 165 are similar to those shown in the
aforementioned article.

Fig. 10 is a detailed circuit diagram for the variable
25 gain circuits 107, 109, 111 and 113 shown in Fig. 2. The
configuration of each circuit is the same and is well known.
For instance, in circuit 107 the summed collector currents of

0221254

transistors 302 and 304 are responsive to a base current of transistor 306.

Fig. 11 shows characteristics of control voltage generator circuit 115 shown in Fig. 9, wherein the abscissa represents the phase shifting amount of the shifting circuit 162, and the ordinate presents control voltages appearing at the terminals 166 and 167. A curve 402 represents the voltage V_{\cos} appearing at the terminal 166, and a curve 404 represents the voltage V_{\sin} appearing at the terminal 167. The voltage 402 varies in proportion to $\sin \alpha$ and the voltage 404 varies in proportion to $\cos \alpha$ for the phase shifting amount α .

Fig. 12 shows the characteristics of the gain control circuits 107 and 113 shown in Fig. 10, and wherein the abscissa represents the control voltage and the ordinate represents the gain. A line 406 represents the transmission characteristics, and the gain will become zero when the control voltage is the same as the reference voltage V_{ref} of the d-c voltage source 310 in Fig. 10.

Fig. 13 is a block diagram showing another control voltage generator circuit, wherein the portions having the same function as those of Fig. 1 are denoted by the same reference numerals. In Fig. 13, reference numeral 500 denotes an analog-to-digital converter (hereinafter referred to as an A/D converter), 501 denotes an address signal generator, 503 and 504 denote ROM's (read only memories), and 505 and 506 denote digital-to-analog converters (hereinafter

1 referred to as D/A converters). A voltage applied to a
terminal 168 is encoded by the A/D converter 500. The
address generator 501, generates address signals that
correspond to the encoded value from A/D converter 500. The
data to be written in ROM's 503 and 504 is selected from the
values which make a desired V_{cos} or V_{sin} curve. Therefore,
the voltages at terminal 166,167 change along curves 412 and
414 shown in Fig. 14.

10 Fig. 14 is a diagram showing the relationship between
the address signals and control voltages wherein the abscissa
represents address signals and the ordinate represents
control voltages. A curve 412 represents a control voltage
 V_{sin} and a curve 414 represents a control voltage V_{cos} .

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0221254

Voltage on terminal 68 (V)	Address signals								Data of ROM 503								Data of ROM 504							
	A ₇	A ₆	A ₅	A ₄	A ₃	A ₂	A ₁	A ₀	D ₇	D ₆	D ₅	D ₄	D ₃	D ₂	D ₁	D ₀	D ₇	D ₆	D ₅	D ₄	D ₃	D ₂	D ₁	D ₀
0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0
0.04	0	0	0	0	0	0	0	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	1
0.08	0	0	0	0	0	0	1	0	1	1	0	1	1	1	0	0	0	0	0	0	0	0	1	0
0.12	0	0	0	0	0	0	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	1	0
0.16	0	0	0	0	0	1	0	0	1	1	0	1	1	1	0	1	0	0	0	0	0	0	1	1
0.2	0	0	0	0	0	1	0	1	1	1	0	1	1	1	0	1	0	0	0	0	0	1	0	0
⋮																								
5.0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
⋮																								
9.28	1	1	1	1	1	1	0	0	1	1	0	1	1	1	0	0	1	1	1	1	1	1	0	1
9.92	1	1	1	1	1	1	0	1	1	1	0	1	1	1	0	0	1	1	1	1	1	1	0	1
9.96	1	1	1	1	1	1	1	0	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0
10	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	0	1	1	1	1	1	1	1	1

1 The above table shows the data that is to be written
into ROM's 503 and 504. The values of data correspond to the
case when the d-c voltage source 510 has a voltage of 10
volts. Described below is the case where the address signal
5 consists of eight bits and the data signal consists of
eight bits. As required, however, the number of bits can be
increased or decreased.

When the voltage applied to terminal 168 is zero volt,
sin -45° volt (-0.71 volt) is produced at terminal 166 and
10 cos -45° volt (0.71 volt) is produced at terminal 167. When
the voltages applied to terminal 168 is 5 volts, sin 0° volt
(0 volt) is produced at terminal 166 and cos 0° volt (1
volt) is produced at terminal 167. When the voltage applied
to the terminal 168 is 10 volts, sin 45° volt (0.71 volt) is
15 produced at terminal 166 and cos 45° volt (0.71 volt) is
produced at terminal 167. The D/A convertor 506 has a
conversion gain that is 0.707 times as great as the conver-
sion gain of the D/A converter 505. The reason for this is
to obtain control voltages which are shown in Fig. 14, when
20 the data signals D_0 to $D_7 = 0$ are changed to D_0 to $D_7 = 1$,
that is, both curves 412 and 414 have the same absolute value
at addresses A_0 and A_{255} .

CLAIMS

1 1. A color tone adjusting apparatus comprising:

color signal means for generating a pair of color
difference signals each of which appears as one component on
a respective one of a pair of perpendicular axis in a first
5 vector plane;

converter means connected to receive said pair of color
difference signals for generating a pair of modified color
difference signals each of which appears as one component on
a respective one of a pair of perpendicular axis in a second
10 vector plane, said second vector plane corresponding to said
first vector plane rotated around the origin with an angle of
rotation which is indicated by a received control voltage;

control means for supplying to said converter means an
adjustable voltage as said control voltage; and

15 reproducing means connected to receive said pair of
modified color difference signals from said converter means
for reproducing a color picture.

2. A color tone adjusting apparatus in accordance with
20 claim 1, wherein said converter means comprises:

first and second amplifier means each for amplifying one
of said pair of color difference signals with a gain which
varies according to a cosine function;

25 third and fourth amplifier means each for amplifying the
other one of said pair of color difference signals with a
gain which varies according to a sine function;

1 adder means for adding the outputs of said first and
third amplifier means to produce one of said pair of modified
color difference signals; and

5 subtracter means for subtracting the outputs of said
second and fourth amplifier means to produce another of said
pair of modified color difference signals.

3. Color true adjusting apparatus according to claim 2,
wherein each of said first and second amplifier means
10 comprises an amplifier whose gain changes linearly in
response to a control signal supplied thereto and cosine
voltage generator means responsive to an adjustable voltage
for producing said control signals which changes along a
cosine curve in response to the change of said adjustable
15 voltage; and

wherein each of said third and fourth amplifier means
comprises an amplifier whose gain changes linearly in
response to another control signal supplied thereto and sine
voltage generator means responsive to said adjustable voltage
20 for producing said another control signal which changes along
a sine curve in response to changes of said adjustable
voltage.

4. Color tone adjusting apparatus comprising:

25 a first signal source providing a first color difference
signal;

0221254

1 first and second amplifier means each for amplifying
said first color difference signal with a gain which varies
according to a cosine function;

5 a second signal source providing a second color difference
signal;

third and fourth amplifier means each for amplifying
said second color difference signal with a gain which varies
according to a sine function;

10 adder means for adding the outputs of said first and
third amplifier means;

subtractor means for subtracting the outputs of said
second and fourth amplifier means;

reproducing means for reproducing a color picture from
the outputs of said adder means and said subtracter means;

15 and

control means for controlling said gains of said first,
second, third and fourth amplifier means.

20 5. Color tone adjusting apparatus according to claim 4,
wherein each of said first and second amplifier means
comprises an amplifier whose gain changes linearly in
response to a control voltage supplied thereto and cosine
voltage generator means supplied with a DC voltage which
changes linearly, for producing said control voltage which
25 changes along a cosine curve in response to a change of said
DC voltage;

0221254

1 wherein each of said third and fourth amplifier means
comprises another amplifier whose gain changes linearly in
response to another control voltage supplied thereto and sine
voltage generator means supplied with said DC voltage for
5 producing said another control voltage which changes along a
sine curve in response to a change of said DC voltage, and
wherein said control means produces said DC voltage whose
value is adjustable.

10 6. Color picture reproducing apparatus comprising:
a color signal source providing three primary color
signals;

15 first matrix means coupled to said color signal source
for producing one pair of color difference signals and a
luminance signal;

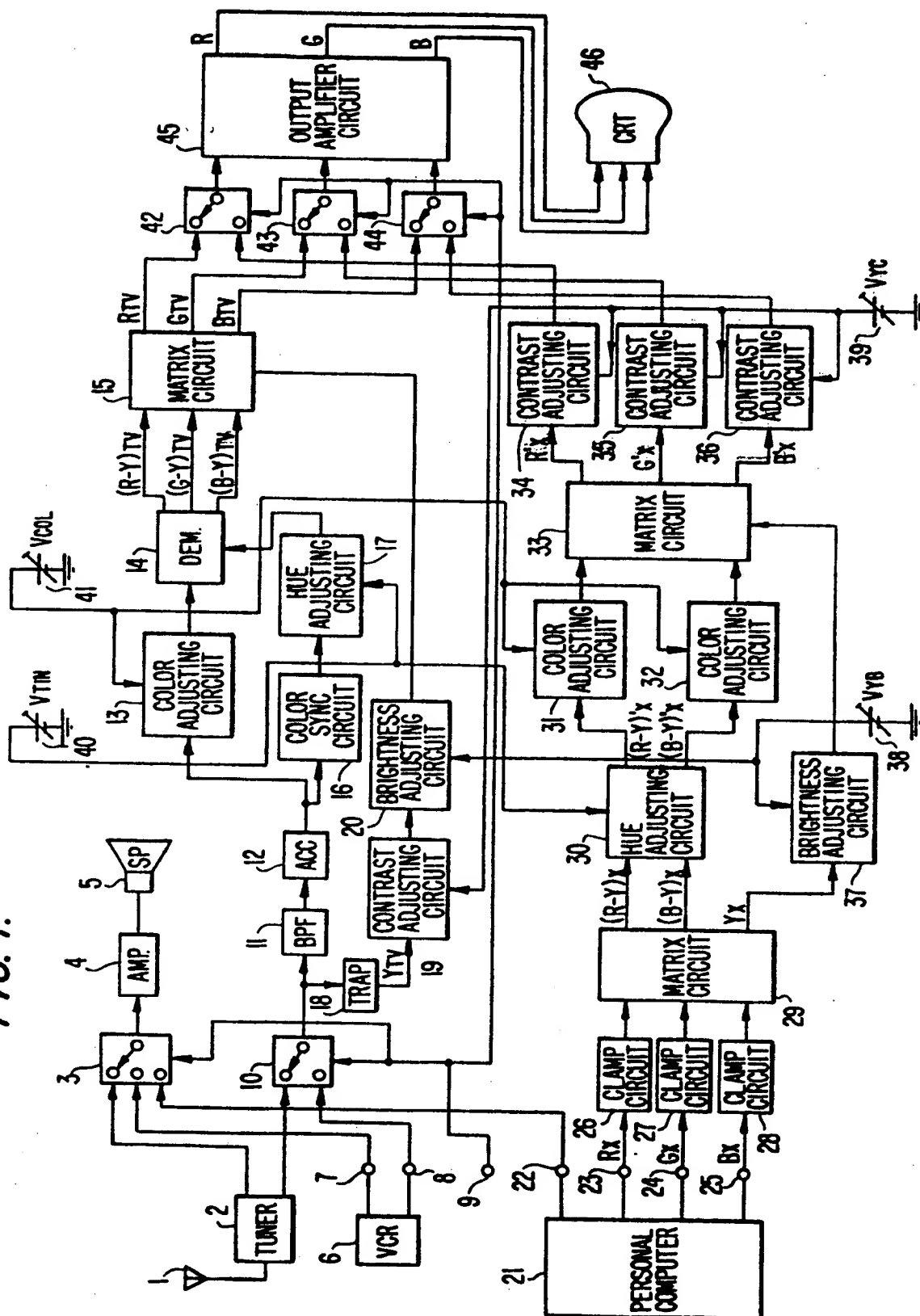
converter means connected to receive said one pair of
color difference signals for producing a pair of modified
color difference signals;

20 second matrix means supplied with said pair of modified
color difference signals and said luminance signal for
producing three modified primary color signals; and

display means for producing a color picture in response
to said three modified primary color signals.

Neu eingereicht / Newly filed
Nouvellement déposé

FIG. 1.



Nou eingereicht / Newly filed
Nouvellement déposé

FIG. 2.

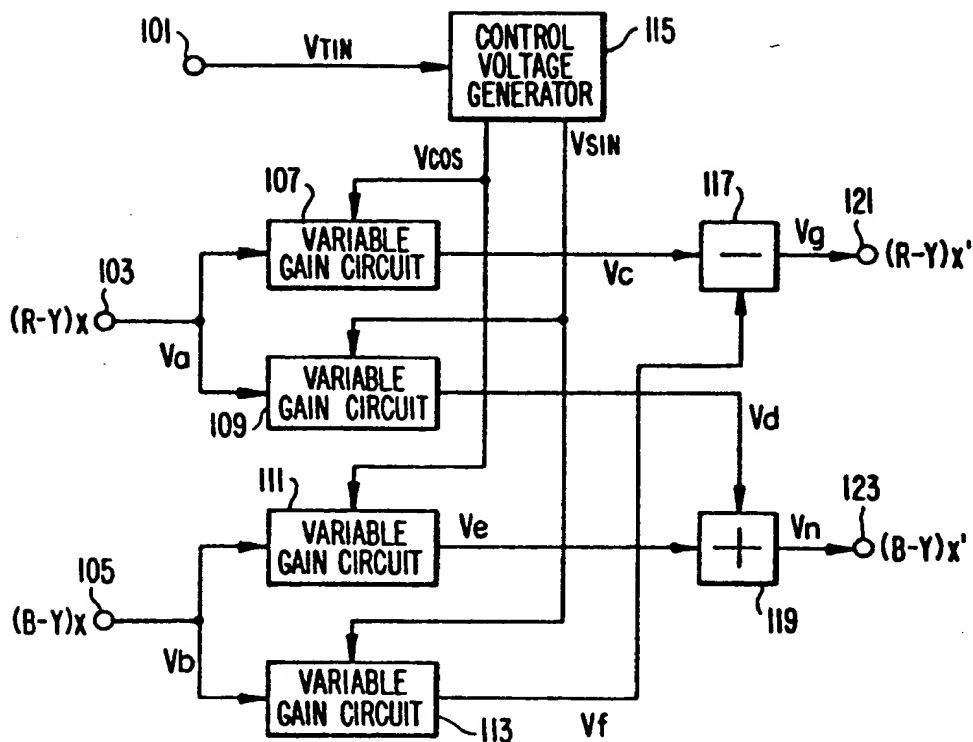
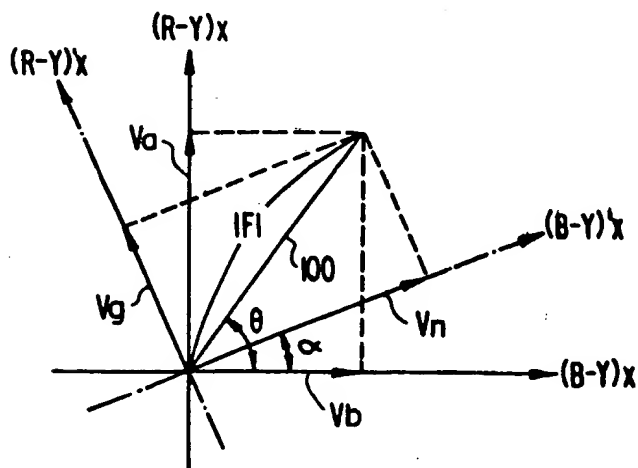


FIG. 3.



0221254

3/8

Neu eingereicht / Newly filed
Neuvalternant d'ordre

FIG. 4.

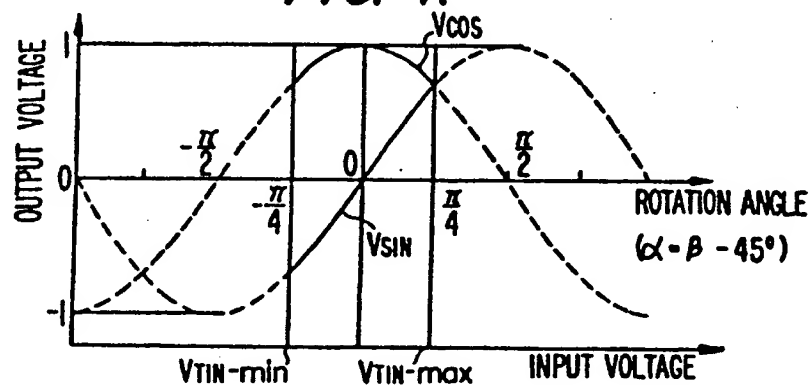


FIG. 5.

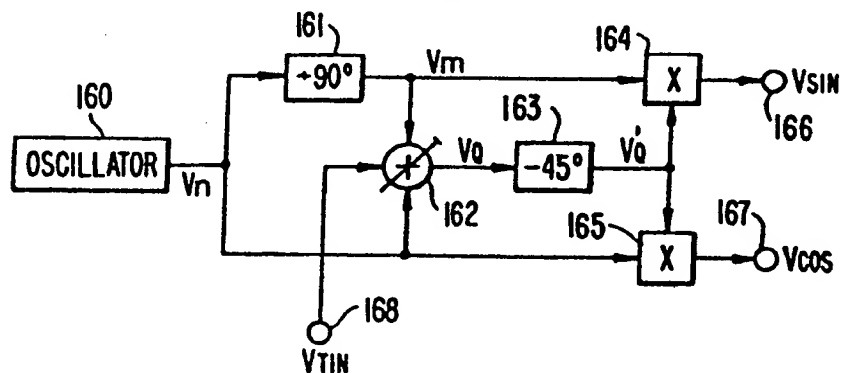


FIG. 6.

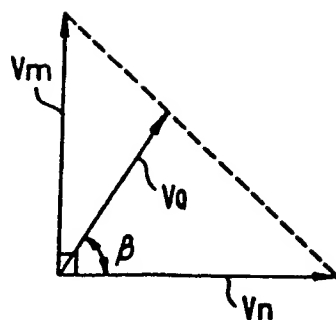


FIG. 7.

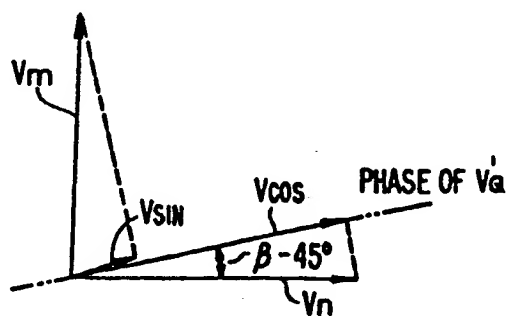
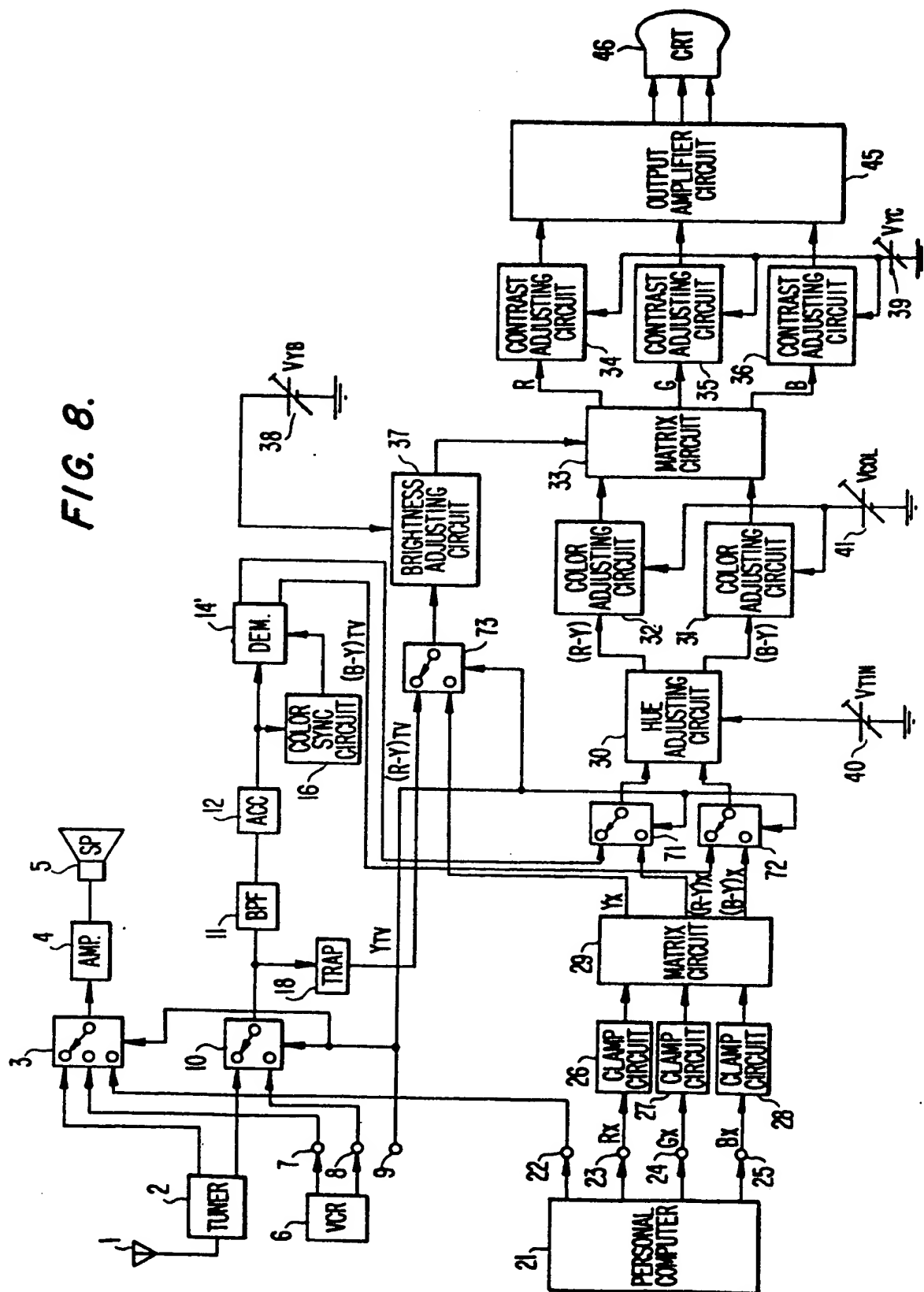


FIG. 8.



Not claimed / Newly filed
Nouvellement déposé

FIG. 9.

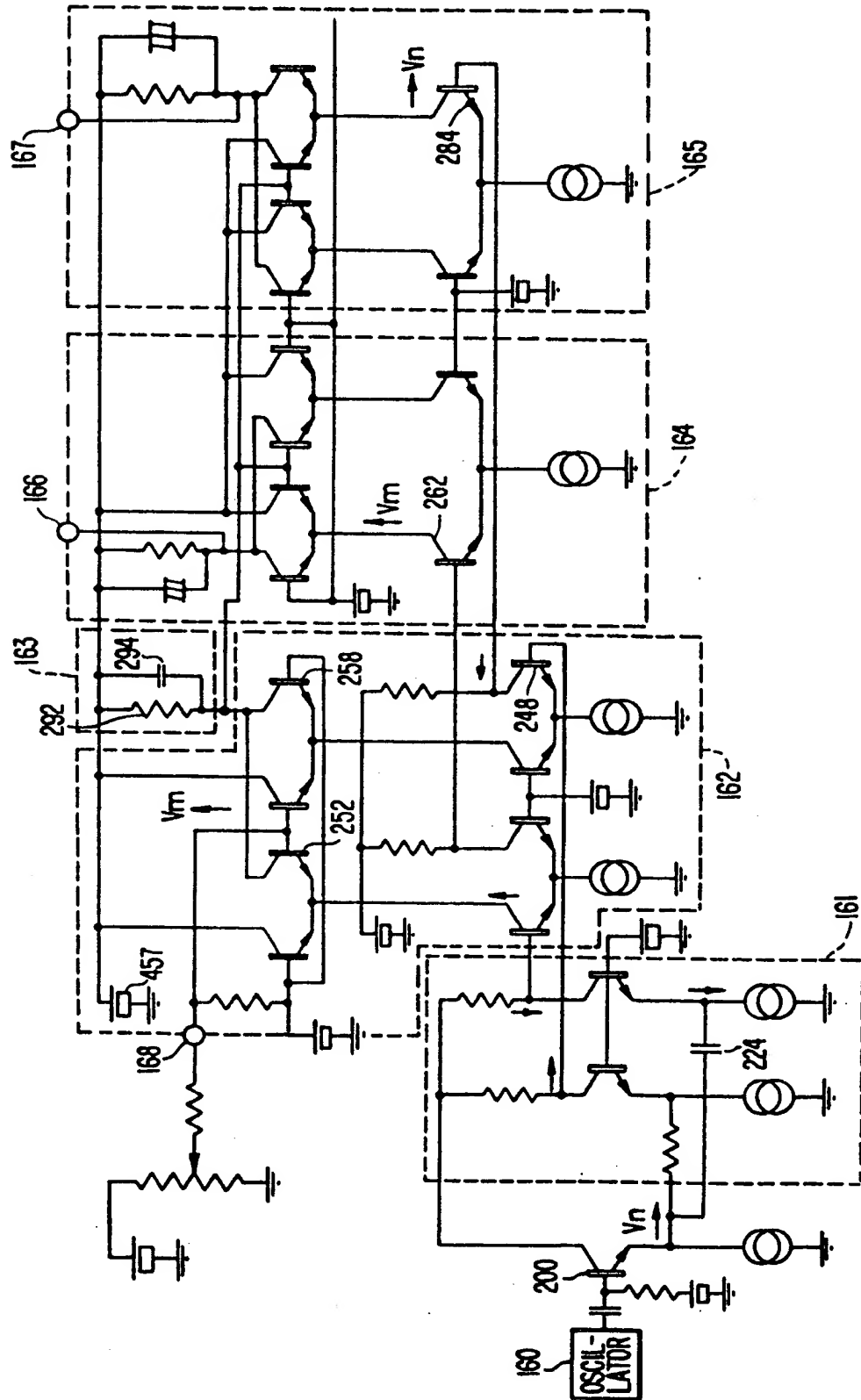
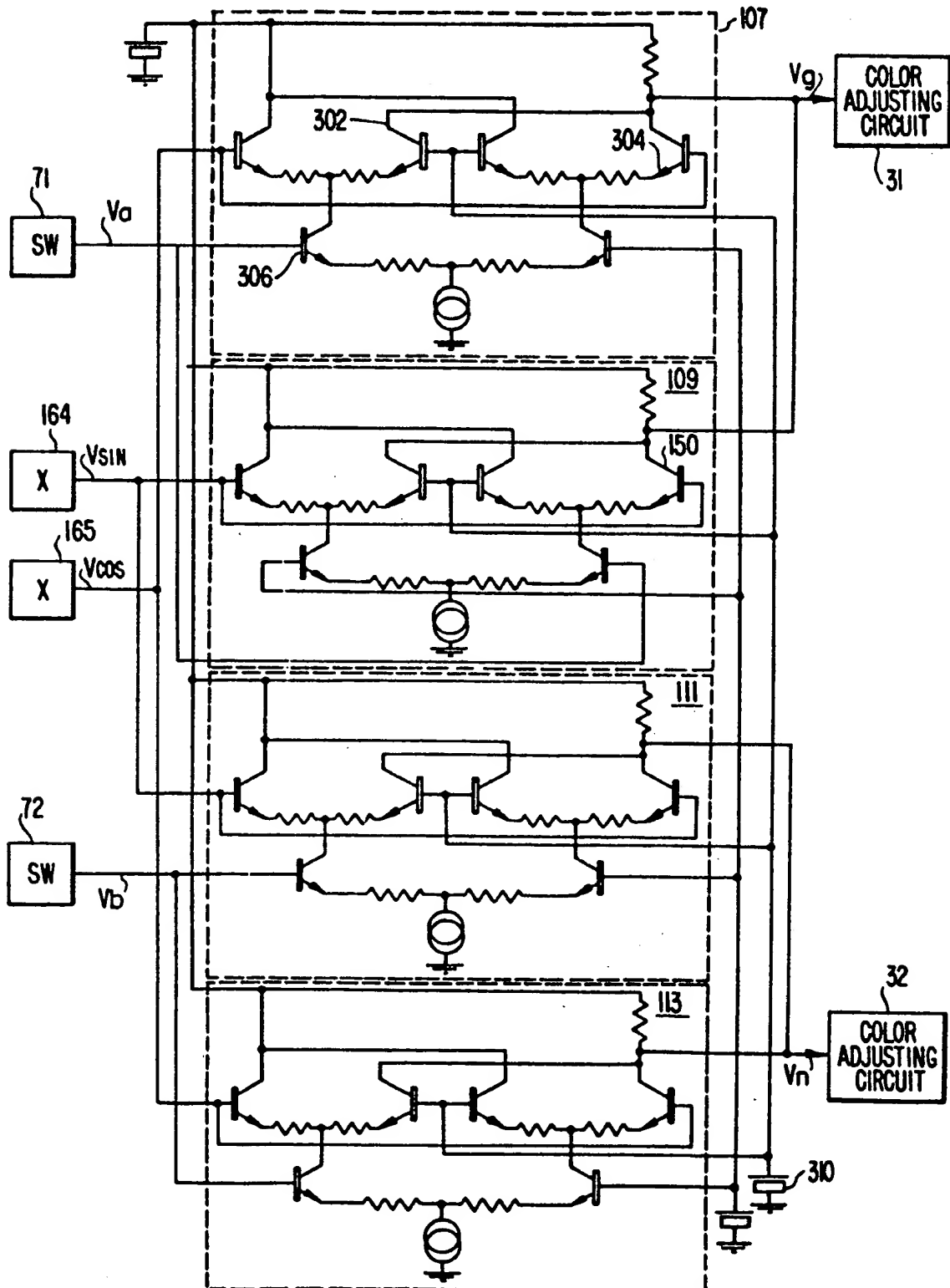


FIG. 10.



0221254

7/8

Neu eingereicht / Newy filed
Nouvellement déposé

FIG. 11.

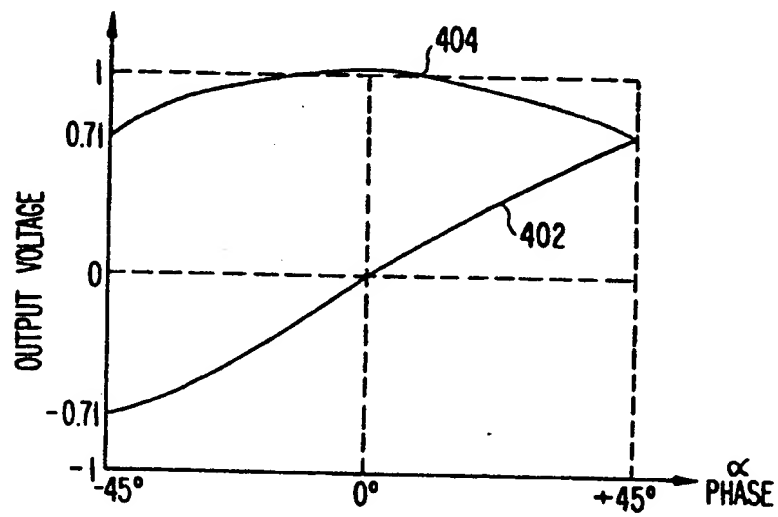


FIG. 12.

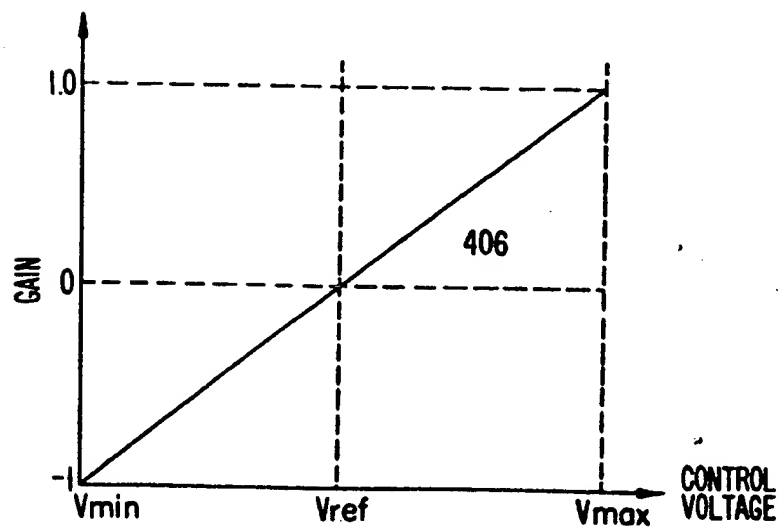
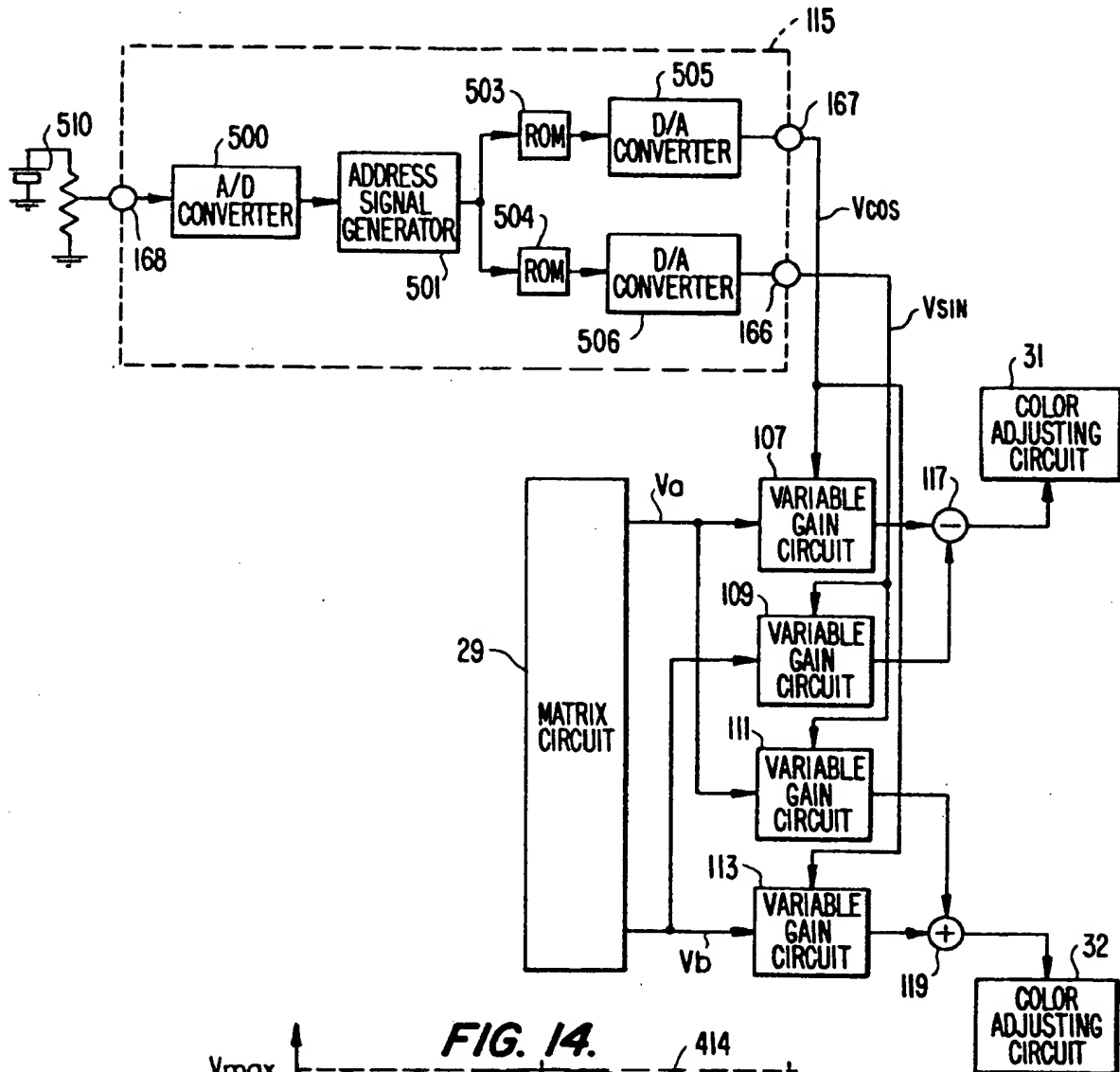


FIG. 13.



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12

EUROPEAN PATENT APPLICATION

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Bulletin 87/20

84 Designated Contracting States: **DE FR GB**

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report: **27.07.88 Bulletin 88/30**

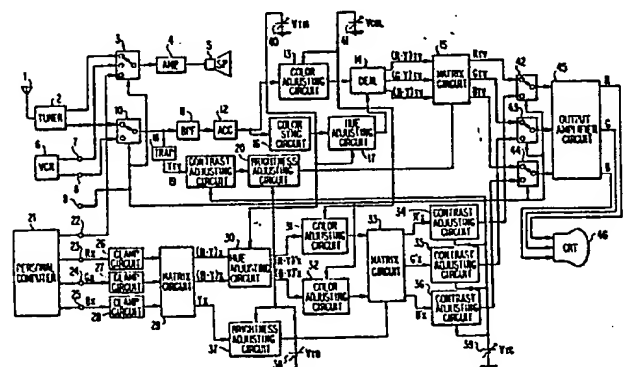
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54 **Color tone adjusting device.**

57 In order to adjust the hue in a color picture reproduced in response to color difference signals, there is provided a converter for converting a pair of color difference signals to another pair of color difference signals, each pair of color difference signals defining the same color vector in different color vector planes having a common origin. The converter includes first amplifiers which amplify the color difference signals with a gain which varies according to a sine function in response to a common control signal second amplifiers which amplify the color difference signals with a gain which varies according to a cosine function in response to the common control signal, and an adder circuit which adds the outputs of one set of first and second amplifiers and a subtracter circuit which subtracts the outputs of another set of first and second amplifiers.





European Patent
Office

EUROPEAN SEARCH REPORT

0221254

Application number

DOCUMENTS CONSIDERED TO BE RELEVANT			EP 86110638.3
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
X,P	<u>DE - A1 - 3 545 113 (CANON)</u> * Fig. 2,3; page 6, line 30 - page 11, line 13 * --	1,6	H 04 N 9/64
A	<u>DE - B - 1 762 241 (MATSUSHITA)</u> * Column 1, lines 4-22; fig. 3; column 3, line 44 - column 4, line 9 * --	1,2,4	
A	<u>US - A - 3 536 827 (BELL)</u> --		
A	<u>US - A - 3 873 760 (WORDEN)</u> ----		
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 11-05-1988	Examiner BENISCHKA
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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